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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 85.

Has been rev.
--see rev.ed.
binders at
end of file.

FISH AS FOOD.

BY

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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., October 31, 1898.

SIR: I have the honor to transmit herewith an article on fish as food, prepared by C. F. Langworthy, of this Office, under the supervision of Prof. W. O. Atwater, special agent in charge of nutrition investigations, in accordance with instructions given by the Director of this Office.

The article is largely based on the investigations of Professor Atwater on the chemical composition and nutritive values of food fishes and aquatic invertebrates, the results of which were published in the reports of the United States Fish Commission for 1880, 1883, and 1888. Other publications of the Fish Commission as well as reports of the New Jersey Experiment Stations (1888–1892) have been consulted, material from other authoritative sources has also been incorporated, and the practical application of scientific investigations regarding the food value of fish has been pointed out and illustrated. The publication of this article as a Farmers' Bulletin is respectfully recommended.

Respectfully,

A. C. TRUE,
Director.

Hon. JAMES WILSON,
Secretary of Agriculture.

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FISH AS FOOD.

INTRODUCTION.

As ordinarily used, the term fish includes, besides the fish proper, many other water animals, as oysters, clams, and other mollusks; lobsters, crawfish, crabs and shrimps; and turtle and terrapin. The term sea food is often used to cover the whole group, or, more particularly, salt water food products as distinguished from those of fresh water.

Fish in one form or another is almost universally recognized as one of the important food materials, and enters to a greater or less extent into the diet of very many if not most American families. Few, however, have any adequate conception of the great importance of the fisheries of the United States and of the immense amount of nutritive material which is every year taken from the salt and fresh waters of this country. From recent data collected by the United States Fish Commission, it appears that more than 616,000,000 pounds of fish, crustaceans, etc., are annually taken from the waters of the New England States; over 596,000,000 pounds from the Middle Atlantic States; over 59,000,000 from the South Atlantic States; 84,000,000 from the Gulf States; 147,000,000 from the Pacific States, and 64,000,000 from Alaska. The products of the fisheries of the Great Lakes exceed 108,000,000 pounds annually and the interior fisheries 19,000,000 pounds. In the case of such products as clams, scallops, and oysters the weight of the edible portion only has been taken into account. The interior fisheries of Vermont are included with those of New England, the fisheries of New York and Pennsylvania on the Great Lakes with those of the Middle Atlantic States, and the fisheries of the east coast of Florida with those of the Gulf States. The data for the Great Lakes embrace only those States not having coast fisheries, but include the fisheries of the Ohio River for Ohio, Indiana, and Illinois. The figures for the interior States are confined to States not having coast or Great Lake fisheries. In addition, thousands of pounds of fish are annually caught by sportsmen, but statistics of the amount are not available.

The total weight of these products as they leave the hands of the fishermen is about 1,696,000,000 pounds, representing, as the value of the catch, $47,180,000. By the processes of canning, salting, smoking, and otherwise preserving, the value of the fish is very much increased.

Of the very large quantity of fish annually placed on the American market, the greater part is consumed at home although a portion is prepared in various ways for export.

The preference for fresh-water or salt-water fish is a matter of individual taste. Both are, so far as known, equally wholesome. The market value of fish is affected by various conditions. Among these are the locality from which they come, the season in which they are taken, and the food on which they have grown. In general, it may be said that fish from clear, cold, or deep water are regarded as preferable to those from shallow or warm water, while fish taken in waters with a rocky or sandy bottom are preferable to those from water with a muddy bottom. Some fish, for instance shad, are at their best during the spawning season, while others should not be eaten during this period. Those fish which feed on small crustacea and other forms of animal and vegetable life, which are their natural food, are preferable to those living upon sewage and other matter which may contaminate the waters. (See p. 29.)

The mode of capture also affects the market value. Fish caught by the gills and allowed to die in the water by slow degrees, as is the case where gill nets are used, undergo decomposition very readily and are inferior for food. Fish are often landed alive and allowed to die slowly. This custom is not only inhumane, but lessens the value of the fish. It has been found that fish killed immediately after catching remain firm and bear shipment better than those allowed to die slowly. The quality of the fish is often injured by improper handling in the fishing boats before placing on the market. Improvement in chilling apparatus and in other lines have made it possible to bring fish to market from distant fishing grounds in good condition.

The flavor of oysters is affected more or less by the locality in which they have grown, those from certain regions being regarded as of very superior quality. The season of the year affects the market value of oysters, although it is noticeable that as methods of transportation and preservation improve, the oyster season becomes longer. This may also be said of lobsters, crabs, etc. Extended investigations, including the conditions affecting the growth and food value of oysters, their parasites and diseases, etc., have been carried on by the New Jersey Experiment Stations. These investigations have shown that oysters rapidly deteriorate when removed from the water, through the fermentative action of bacteria; and that oysters in spawn deteriorate more rapidly than at any other season at the same temperature. However, oysters which are ready to spawn are considered especially palatable if cooked soon after removal from the sea bed.

PREPARING FISH FOR MARKET.

Fish are sold either "round," i. e., whole, or dressed. Sometimes only the entrails are removed. Often, however, especially when dressed for cooking, the head, fins, and, less frequently, the bones, are removed. This entails a considerable loss in weight as well as of nutritive material.

It has been assumed that in dressing fish the following percentages are lost: Large-mouthed black bass, sea bass, cisco, kingfish, mullet, white perch, pickerel, pike, tomcod, weakfish, and whitefish, each, 17½ per cent; small-mouthed black bass, eel, Spanish mackerel, porgy, and turbot, each, 13½ per cent; butter-fish, 12½ per cent; shad, 11 per cent; and brook trout, 16½ per cent. More recent figures for loss in weight in dressing are as follows: Bullhead, 50 per cent; buffalo-fish and lake sturgeon, 40 per cent; carp and sucker, 35 per cent; fresh-water sheepshead, 23 per cent; grass pike, black bass, white bass, yellow perch, and salmon, 15 per cent; and eels, 10 per cent.

Fresh-water and salt-water fish alike are offered for sale as taken from the water, and preserved in a number of ways. In some cases preservation is only to insure transportation to remote points in good condition. Low temperature is the means most commonly employed for this purpose. By taking advantage of the recent improvements in apparatus and methods of chilling and freezing, fish may be shipped long distances and kept a long time in good condition. Some of the dangers from eating fish which is not in good condition are pointed out on p. 29.

Large quantities of fish are dried, salted, and smoked, the processes being employed alone or in combination. These methods insure preservation, but at the same time modify the flavor. Several fish products are also prepared by one or more of these processes. Caviare, which may be cited as an example, is usually prepared from sturgeon roe by salting. The methods of salting and packing vary somewhat and give rise to a number of varieties. Although formerly prepared almost exclusively in Russia, caviare is now made to a large extent in the United States.

When fish are salted and cured, there is a considerable loss in weight due to removal of the entrails, drying, etc. Codfish lose 60 per cent in preparation for market. If the market-dried fish is boned, there is a further loss of 20 per cent. The loss in weight of pollock from the round to the market-dried fish is 60 per cent; haddock, 62 per cent; hake, 56 per cent; and cusk, 51 per cent.

The canning industry has been enormously developed in recent years and thousands of pounds of fish, oysters, lobsters, etc., are annually preserved in this way. In canning, the fish or other material is heated (the air being sometimes exhausted also) to destroy micro-organisms, and sealed to prevent access of air which would introduce micro-organisms as well as oxygen. Thus the canned contents are preserved from oxidation and decomposition. The processes of canning have been much improved, so that the original flavor is largely retained, while the goods may be kept for an indefinite period. Fish, as well as meat, is usually canned in its own juice or cooked in some form. Sardines and some other fishes are commonly preserved by canning in oil.

Various kinds of fish extract, clam juice, etc., are offered for sale. These are similar in form to meat extract. There are also a number of

fish pastes and similar products—anchovy paste, for instance—which are used as relishes or condiments.

Preservatives such as salicylate of soda are employed to some extent in fish and especially oysters for shipping. The extended use of such materials is not desirable since some of them are justly regarded as harmful.

Oysters and other shellfish are placed on the market alive in the shell or are removed from the shell and kept in good condition by chilling or other means. Oysters in the shell are usually transported in barrels or sacks. Shipment is made to far inland points in refrigerator cars and to Europe in the cold-storage chambers of vessels. Large quantities of shellfish are also canned. Oysters are often sold as they are taken from the salt water. However, the practice of "freshening," "fattening," or "floating" is very widespread—that is, oysters are placed in fresh or brackish water for a short period. They become plump in appearance and have a different flavor from those taken directly from salt water (see p. 16). As noted on page 29, care should be taken that the oysters are fattened in water which is not contaminated by sewage.

Lobsters, crabs, and other crustacea are usually sold alive. Sometimes they are boiled before they are placed on the market. Large quantities of lobsters, shrimps, and crabs are canned.

Turtle and terrapin are usually marketed alive. Turtle soup, however, is canned in large quantities. Frogs are marketed alive or dressed. The hind legs only are commonly eaten. Frogs may be eaten in all seasons, but are in the best condition in fall or winter.

NUTRITIVE VALUE OF FISH.

COMPOSITION OF FISH.

Fish contain the same kind of nutrients as other food materials. In general it may be said that food (fish, meat, cereals, vegetables, etc.) serves a twofold purpose: It supplies the body with material for building and repairing its tissues and fluids, and serves as fuel for maintaining body temperature and for supplying the energy necessary for muscular work.

The body is like a machine, with food for its fuel. The body differs from a machine, however, in that the fuel, i. e., food, is used to build it as well as to supply it with energy. Further, if the body is supplied with more food than is needed, the excess can be stored as reserve material, usually in the form of fat. In the furnace fuel is burned quickly, yielding heat and certain chemical products—carbon dioxid, water vapor, and nitrogen. In the body the combustion takes place much more slowly, but in general the final products are the same. The combustion of nitrogen is, however, not so complete as in a furnace. Due allowance is made for this fact in calculations involving the question of the energy which food will furnish.

Food consists of an edible portion and refuse, i. e., bones of fish and meat, shells of oysters, bran of wheat, etc. Although foods are so different in appearance, chemical analysis shows that they are all made up of a comparatively small number of chemical compounds. These are water and the so called nutrients, protein or nitrogenous materials, fat, carbohydrates, and ash, or mineral matter. Familiar examples of protein are lean of meat and fish, white of egg, casein of milk (and cheese), and gluten of wheat. Fat is found in fat meats, fish, lard, fat of milk (butter), and oils, such as olive oil. Starches, sugars, and woody fiber or cellulose form the bulk of the carbohydrates. Certain carbohydrates are found in meat and fish, although the amount is not large. The protein, fats, and carbohydrates are all organic substances—that is, they can be burned with the formation of various gases, chiefly carbon dioxid and water, leaving no solid residue. The mineral matters will not burn and are left behind when organic matter is ignited. By analysis the nutrients have been found to be made up of a comparatively small number of chemical elements in varying combinations. These are nitrogen, carbon, oxygen, hydrogen, phosphorus, sulphur, calcium, magnesium, sodium, potassium, silicon, chlorin, fluorin, and iron. Doubtless no single nutrient contains all these elements. The body tissues and fluids contain nitrogen; and hence protein, which alone supplies nitrogen to the body, is a necessary factor in food. All the nutrients except mineral matter contain carbon, oxygen, and hydrogen, and can supply them to the body. Protein, fat, and carbohydrates are all sources of energy.

The value of a food for building and repairing the body is shown by its chemical composition—that is, by the amount of the different nutrients which it contains. Some other means is necessary to show its value as a source of energy. It is known that all energy may be measured in terms of heat. In order to have some measure for expressing the amount of heat, the calorie is taken as a unit. Roughly speaking, this is the amount of heat required to raise the temperature of 1 pound of water 4° F. One pound of sugar or starch would, if burned and all the heat utilized, raise 1,860 pounds of water 4 degrees in temperature; or it would raise 5 gallons of water from the freezing point to the boiling point, but would not cause it to boil.

The number of calories which different foods will supply may be determined by burning them in an apparatus called a calorimeter, or by taking the sum of the calories which it is calculated the protein, fat, and carbohydrates making up the food would furnish. It has been found by experiment that the fuel value of a pound of protein as ordinarily burned in the body is 1,860 calories; the fuel value of a pound of carbohydrates is the same; while that of a pound of fat is 2¼ times as great.

The value of a food is usually judged by several different standards. Thus it must be digestible and palatable, furnish the nutrients needed by the system in proper amounts, and be reasonably cheap.

The relative nutritive value of any food is shown by comparing its composition with other foods. Table 1 shows the composition of a number of food fishes, fresh and preserved in a variety of ways; oysters, clams, and other mollusks; lobsters, shrimps, crawfish, and crabs; turtle and terrapin, and frogs' legs. For purposes of comparison the analyses of a number of kinds of meat, vegetables, and other common food materials, are included.

In several cases the analysis of fish, whole and dressed, is given. Usually the composition of the dressed fish was computed from that of whole fish with the aid of the figures for loss of weight in dressing for market, mentioned on page 9.

TABLE 1.—*Composition of fish, mollusks, crustaceans, etc.*

Kind of food material.	Refuse (bone, skin, etc.).	Salt.	Water.	Protein.	Fats.	Carbohydrates.	Mineral matter.	Total nutrients.	Fuel value per pound.
Fresh fish.	*Per ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Calories.*
Alewife, whole	49.5	......	37.5	9.7	2.5	......	0.8	13	285
Bass, large-mouthed black, dressed	46.7	......	41.9	10.3	.5	......	.6	11.4	215
Bass, large-mouthed black, whole	56	......	34.6	8.5	.4	......	.5	9.4	175
Bass, small-mouthed black, dressed	46.4	......	40.1	11.5	1.3	......	.7	13.5	270
Bass, small-mouthed black, whole	53.6	......	34.7	10	1.1	......	.6	11.7	230
Bass, sea, dressed	46.8	......	42.2	10.1	.2	......	.7	11	195
Bass, sea, whole	56.1	......	34.8	8.3	.2	......	.6	9.1	160
Bass, striped, dressed	51.2	......	37.4	8.7	2.2	......	.5	11.4	255
Blackfish, dressed	55.7	......	35	8.3	.5	......	.5	9.3	175
Bluefish, dressed	48.6	......	40.3	9.8	.6	......	.7	11.1	205
Butterfish, dressed	34.6	......	45.8	11.7	7.2	......	.7	19.6	520
Butterfish, whole	42.8	......	40.1	10.2	6.3	......	.6	17.1	455
Carp (European analysis)	37.1	......	48.4	12.9	.7	......	.9	14.5	270
Cod, dressed	29.9	......	58.5	10.6	.2	......	.8	11.6	205
Cod, steaks	9.2	......	72.4	16.9	.5	......	1	18.4	335
Cusk, dressed	40.3	......	49	10.1	.1	......	.5	10.7	190
Eel, salt-water, dressed	20.2	......	57.2	14.6	7.2	......	.8	22.6	575
Flounder, common, dressed	57	......	35.8	6.3	.3	......	.6	7.2	130
Flounder, winter, dressed	56.2	......	37	6.1	.2	......	.5	6.8	120
Hake, dressed	52.5	......	39.5	7.2	.3	......	.5	8	145
Haddock, dressed	51	......	40	8.2	.2	......	.6	9	160
Halibut, dressed	17.7	......	61.9	15.1	4.4	......	.9	20.4	465
Herring, whole	46	......	37.3	10	5.9	......	.8	16.7	435
Mackerel, dressed	40.7	......	43.7	11.4	3.5	......	.7	15.6	360
Mackerel, Spanish, dressed	24.4	......	51.4	15.8	7.2	......	1.2	24.2	595
Mackerel, Spanish, whole	34.6	......	44.5	13.7	6.2	......	1	20.9	515
Mullet, dressed	49	......	38.2	9.8	2.4	......	.6	12.8	285
Mullet, whole	57.9	......	31.5	8.1	2	......	.5	10.6	235
Perch, white, dressed	54.6	......	34.4	8.7	1.8	......	.5	11	235
Perch, white, whole	62.5	......	28.4	7.2	1.5	......	.4	9.1	195
Perch, yellow, dressed	35.1	......	50.7	12.6	.7	......	.9	14.2	265
Pickerel, dressed	35.9	......	51.1	11.9	.2	......	.9	13	230
Pickerel, whole	47.1	......	42.2	9.8	.2	......	.7	10.7	190
Pike, dressed	30.5	......	55.4	13	.4	......	.7	14.1	260
Pike, whole	42.7	......	45.7	10.7	.3	......	.6	11.6	210
Pollock, dressed	28.5	......	54.3	15.5	.6	......	1.1	17.2	315
Pompano, dressed	45.5	......	39.5	10.2	4.3	......	.5	15	370
Porgy, dressed	53.7	......	34.6	8.6	2.4	......	.7	11.7	260
Porgy, whole	60	......	29.9	7.4	2.1	......	.6	10.1	225
Red grouper, dressed	55.9	......	35	8.4	.2	......	.5	9.1	165
Red snapper, dressed	48.9	......	40.3	9.6	.6	......	.6	10.8	205
Salmon, California (sections)	5.2	......	60.3	16.5	17	......	1	34.5	1,025
Salmon, Maine, dressed	23.8	......	51.2	14.6	9.5	......	.9	25	675
Shad, dressed	43.9	......	39.6	10.3	5.4	......	.8	16.5	420
Shad, whole	50.1	......	35.2	9.2	4.8	......	.7	14.7	375
Shad, roe	....	......	71.2	23.4	3.8	......	1.6	28.8	595
Smelt, whole	41.9	......	46.1	10	1	......	1	12	230
Sturgeon, dressed	14.4	......	67.4	15.4	1.6	......	1.2	18.2	355
Tomcod, dressed	51.4	......	39.6	8.2	.3	......	.5	9	165
Tomcod, whole	59.9	......	32.7	6.8	.2	......	.4	7.4	135
Trout, brook, dressed	37.9	......	48.4	11.7	1.3	......	.7	13.7	275
Trout, brook, whole	48.1	......	40.4	9.8	1.1	......	.6	11.5	230
Trout, lake, dressed	35.2	......	45	12.4	6.6	......	.8	19.8	510
Turbot, dressed	39.5	......	43.1	7.9	8.7	......	.8	17.4	515
Turbot, whole	47.7	......	37.3	6.8	7.5	......	.7	15	440
Weakfish, dressed	41.7	......	46.1	10.2	1.3	......	.7	12.2	245
Weakfish, whole	51.9	......	38	8.4	1.1	......	.6	10.1	200

TABLE 1.—*Composition of fish, mollusks, crustaceans, etc.*—Continued.

Kind of food material.	Refuse (bone, skin, etc.).	Salt.	Water.	Protein.	Fats.	Carbohydrates.	Mineral matter.	Total nutrients.	Fuel value per pound.
Fresh fish—Continued.	*Per ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Calories.*
Whitefish, dressed	43.6	......	39.4	12.5	3.6	......	0.9	17	385
Whitefish, whole	53.5	......	32.5	10.3	3	......	.7	14	320
General average of fresh fish as sold	42	......	44	10.5	2.5	......	1	14	300
Preserved fish.									
Mackerel, "No. 1," salted	33.3	7.1	28.1	14.7	15.1	......	1.7	31.5	910
Cod, salted and dried	24.9	17.2	40.3	16	.4	......	1.2	17.6	315
Cod, "boneless codfish," salted and dried	......	21.5	54.4	22.1	.3	......	1.7	24.1	425
Caviare	......	......	38.1	30	19.7	7.6	*a* 4.6	61.9	1,530
Herring, salted, smoked, and dried	44.4	6.5	19.2	20.2	8.8	......	.9	29.9	[illegible]45
Haddock, "Findon haddie," salted, smoked, and dried	32.2	1.4	49.2	16.1	.1	......	1	17.2	305
Halibut, salted, smoked, and dried	6.9	12.1	46	19.1	14	......	1.9	35	945
Sardines, canned	5	......	53.6	24	12.1	......	5.3	41.4	955
Salmon, canned	3.9	1	59.3	19.3	15.3	......	1.2	35.8	1,005
Mackerel, canned	......	1.9	68.2	19.9	8.7	......	1.3	29.9	735
Mackerel, salt, canned	19.7	8.3	34.8	13.8	21.3	......	2.1	37.2	1,155
Tunny (horse-mackerel), canned	......	......	72.7	21.5	4.1	......	1.7	27.3	575
Haddock, smoked, canned	......	5.6	68.7	21.8	2.3	......	1.6	25.7	505
Mollusks.									
Oysters, solids	......	......	88.3	6.1	1.4	3.3	.9	11.7	235
Oysters, in shell	82.3	......	15.4	1.1	.2	.6	.4	2.3	40
Oysters, canned	......	......	85.3	7.4	2.1	3.9	1.3	14.7	300
Scallops	......	......	80.3	14.7	.2	3.4	1.4	19.7	345
Long clams, in shell	43.6	......	48.4	4.8	.6	1.1	1.5	8	135
Long clams, canned	......	......	84.5	9	1.3	2.9	2.3	15.5	275
Round clams, removed from shell	......	......	80.8	10.6	1.1	5.2	2.3	19.2	340
Round clams, in shell	68.3	......	27.3	2.1	.1	1.3	.9	4.4	65
Round clams, canned	......	......	83	10.4	.8	3	2.8	17	285
Mussels	49.3	......	42.7	4.4	.5	2.1	1	8	140
General average of mollusks (exclusive of canned)	60.2	......	34	3.2	.4	1.3	.9	5.8	100
Crustaceans.									
Lobster, in shell	62.1	......	31.1	5.5	.7	......	.6	6.8	130
Lobster, canned	......	......	77.8	18.1	1.1	.6	2.4	22.2	395
Crawfish, in shell	87.7	......	10	2	.1	.1	.1	2.3	45
Crab, in shell	55.8	......	34.1	7.3	.9	.5	1.4	10.1	185
Crab, canned	......	......	80	15.8	1.5	.8	1.9	20	370
Shrimp, canned	......	......	70.8	25.4	1	.2	2.6	29.2	520
General average of crustaceans (exclusive of canned)	73.7	......	20.9	4.3	.4	.2	.5	5.4	100
Terrapin, turtle, etc.									
Terrapin, in shell	79	......	15.6	4.5	.7	......	.2	5.4	115
Green turtle, in shell	76	......	19.1	4.5	.1	......	.3	4.9	90
Average of turtle and terrapin	77.5	......	17.4	4.2	.7	......	.2	5.1	105
Frogs' legs	32	......	57	10.2	.1	......	.7	11	210
General average of fish, mollusks, crustaceans, etc	44	......	42.5	10	2.5	.1	.9	13.5	295
Other animal foods.									
Beef, side, medium fat	17.4	......	49.4	14.4	18.1	......	.7	33.2	1,030
Veal, side	22.6	......	55.2	15.1	6.3	......	.8	22.2	545
Mutton, side	19.3	......	43.3	12.7	24	......	.7	37.4	1,250
Average of beef, veal, and mutton	20	......	49.5	14.2	15.6	......	.7	30.5	920
Pork, side	11.2	......	26.1	7.5	54.8	......	.4	62.7	2,455
Chicken	26.6	......	47.2	14	11.5	......	.7	26.2	750
Turkey	22.7	......	42.4	15.7	18.4	......	.8	34.9	1,070
Milk	......	......	87	3.3	4	5	.7	13	325
Vegetable foods.									
Wheat flour	......	......	12.1	11.2	1.1	75.2	.4	87.9	1,655
Corn meal	......	......	12.2	9.3	2.4	75.1	1	87.8	1,670
Beans, dried	......	......	12.8	22.5	1.8	59.3	3.6	87.2	1,595
Potato	20	......	62.6	1.7	.1	14.8	.8	17.4	310
Cabbage	15	......	77.7	1.4	.2	4.8	.9	7.3	125
Corn, canned	......	......	75.8	2.8	1.2	19.3	.9	24.2	460
Salad greens	......	......	86.7	4.2	.6	6.3	2.2	13.3	220
Apples	25	......	62.9	.3	.4	11.2	.2	12.1	230
Bananas	35	......	48.1	.8	.5	15.1	.5	16.9	315
Strawberries	......	......	90.4	1	.7	7.3	.6	9.6	185

a Including salt.

The above list includes the more important food fishes, water invertebrates, etc. There are numbers of other fish which are eaten to a greater or less extent. In general it may be said their composition would be similar to that of the fishes included in the table. It is noticeable that many kinds of fish which are known to be wholesome are seldom eaten. Among others may be mentioned the whiting, or silver hake, and the sea robin. The latter are taken in enormous quantities in certain regions. This prejudice against certain fish is largely local; for instance, skates are eaten on the western coast of the United States, but until recently they were regarded as of no value in the East. A few years ago sturgeon and eel were not generally eaten. To-day sturgeon is much prized, and in regions where it was formerly worthless commands a high price.

In a number of cases cited in the table above more than one specimen was analyzed, although only the averages are given in the table. In such cases the samples showed more or less variation in total nutrients, but the variation was due more especially to the fats. Thus the fat in the flesh of seven specimens of shad ranged from 6.5 to 13.6 per cent; in fresh mackerel from 2.2 to 16.3 per cent, and in fresh halibut from 2.2 to 10.6 per cent. The protein and mineral matters remained practically the same in all these specimens where the wide fat variation was noticeable, an increase of fat being marked by a decrease of water.

It will be seen from the table that fish is essentially a nitrogenous food. In this it resembles meat. Neither fish nor meat is a source of carbohydrates. Oysters contain some carbohydrates, but the foods which supply this group of nutrients most abundantly are the cereal grains.

In general, it may be said that fish, meat, eggs, milk, etc., also cereals and vegetable foods, all supply fat, the amount varying in the different materials. Fish usually contains less fat than is found in meat. There is, however, much difference in the fat content of the various kinds of fish. They may, indeed, be roughly divided into three classes: The first class would include those containing over 5 per cent fat; the second those containing between 2 and 5 per cent, and the third those containing less than 2 per cent. The first group would include such fish as salmon, shad, herring, Spanish mackerel, and butter-fish; the second, white fish, mackerel, mullet, halibut, and porgy; the third, smelt, black bass, bluefish, white perch, weakfish, brook trout, hake, flounder, yellow perch, pike, pickerel, sea bass, cod, and haddock.

The so-called nitrogenous extractives ("meat extract"), contained in small quantities in fish as in other animal foods, are doubtless useful in nutrition, although their function is not definitely known.

The place of fish in the diet, if judged by its composition, is the same as that of meat; that is, it is supplementary to cereals and other vegetables, the most of which, as wheat, rye, maize, rice, potatoes, etc., are deficient in protein, the chief nutrient in the flesh of fish.

Preserved fish, as a rule, show a small percentage of refuse, with the exception of a few kinds which are preserved whole. The percentage of actual nutrients is much larger than in the corresponding fresh fish, owing to the removal of a large part of the refuse and more or less water. The gain in nutrients is mostly represented by protein, which is the most valuable nutrient.

Canned fish, which is in effect cooked fish, compares favorably as regards composition with the fresh material. Generally speaking, the amount of refuse is small, since the portions commonly rejected in preparation for the table have been removed before canning.

Shellfish resemble meat and food-fishes in general composition. They contain, however, a small amount of carbohydrates. Oysters are the most important of the shellfish, judging by the relative amount consumed. Speaking roughly, a quart of oysters contains on an average about the same quantity of actual nutritive substances as a quart of milk, or three-fourths of a pound of beef, or 2 pounds of fresh codfish, or a pound of bread. But while the weight of actual nutriment in the different quantities of food materials named is very nearly the same, the kind is widely different. That of the lean meat or codfish consists mostly of protein, the substances whose principal function is to make or repair blood, muscle, tendon, bone, brain, and other nitrogenous tissues. That of bread contains considerable protein, but a much larger proportion of starch, with a little fat and other compounds which serve the body as fuel and supply it with heat and muscular power. The nutritive substance of oysters contains considerable protein and fuel ingredients. Oysters come nearer to milk than almost any other common food material as regards both the amounts and the relative proportions of nutrients.

Apparently as the oyster grows older, at least up to a certain time, not only do the proportions of flesh and liquids increase more rapidly than the shells, but the proportion of nutrients in the edible portion increases also; that is to say, 100 pounds of young oysters in the shell appear to contain less of flesh and of liquids than 100 pounds of older ones, and when both have been shucked a pound of shell contents from the older oysters would contain more nutriment than a pound from the younger.

Considering the edible portion of the oyster, after it has been removed from the shell, the differences in different specimens are much greater than is commonly supposed. This is apparent when a comparison is made of either the flesh (meat) or liquids (liquor) of different specimens, or the whole edible portion, the meat (solids) and liquor together. The percentage of water in the edible portion of different specimens of oysters which were analyzed in experiments conducted for the U. S. Fish Commission varied from about 83.4 to 91.4 per cent, and averaged 87.3 per cent. This makes the amounts of "water-free substance," i. e., actually nutritive ingredients, vary from 16.6 to 8.6 and average

12.7 per cent of the whole weight of the edible portion (shell contents) of the animals. In other words, the nutritive material in a quart (about 2 pounds) of shell contents (solids) varied from $2\frac{3}{4}$ to $5\frac{1}{3}$ ounces.

With oysters, long clams, and round clams in the shell there is naturally a large percentage of waste, as the shell is a large portion of the total weight. The average of 34 specimens of oysters in the shell, for instance, shows only 2.3 per cent of actual nutrients. Clams and mussels show a somewhat higher percentage.

Where these various shellfish are purchased as "solids"—that is, removed from the shell—a comparatively high price is usually paid. Where they are purchased in the shell, there is a very large percentage of waste. The conclusion is therefore warranted that, from a pecuniary standpoint, they are not the most economical of foods for the consumer. On the other hand, they have a useful place in the diet in helping to supply the variety which is apparently needed to insure the best workings of the digestive system. Often flavor has a value which can not be estimated in dollars and cents.

As already explained, it is a common practice of oyster dealers, instead of selling the oysters in the condition in which they are taken from the beds in salt water, to place them for a time—forty-eight hours, more or less—in fresh or brackish water, in order, as the oystermen say, to "fatten" them, the operation being also called "floating" or "laying out." By this process the oyster acquires plumpness and rotundity, and its bulk and weight are so increased as materially to increase its selling value. The belief is common among oystermen that this "fattening" is due to actual gain of flesh and fat and that the nutritive value of the oyster is increased by the process. They find that the oysters "fatten" much more quickly in fresh than in brackish water. Warmth is so favorable to the process, that it is said to be sometimes found profitable to warm artificially the water in which the oysters are floated. Although oysters are generally floated in the shell, the same effect is commonly obtained by adding fresh water to the oysters after they have been taken out of the shell. Oysters lose much of their salty flavor in "floating," and it is a common experience of oystermen that if the "fattened" oysters are left too long on the floats they become "lean" again. It does not seem probable that the oysters would secure food enough to make appreciable gain in weight in the short time in which they remain in the fresh or brackish water.

It is known that when a solution of salts is separated by a suitable membrane from water containing a lesser quantity of salts in solution that the passage of salts immediately begins from the concentrated to the dilute solution. This is practically the condition which exists when the oyster is transferred from salt to fresh or brackish water. The fleshy portions of the body which are inclosed in a membrane contain salts in solution. As long as the oyster stays in salt water the solution of salts within its body would naturally be in equilibrium with the

water outside. When the oyster is brought into fresh or brackish water—i. e., into a more dilute solution—it might be expected that the salts in the more concentrated solution within the body would pass out and a larger amount of fresh water enter and produce such a distension as actually takes place during floating. Careful experiments have shown that this supposition is entirely correct—that is, the oysters actually gain in weight. This is due largely to the fact that they lose mineral matter and gain a considerable amount of water. At the same time there is a slight loss of nutrients. When in their natural condition oysters contain from one-eighth to one-fifth more nutritive material than when fattened. In the opinion of very many consumers the improvement in appearance and flavor due to the removal of the salts more than compensates for the loss in nutritive value. It seems also to be a matter of common opinion that oysters keep better when part of the salts has been removed by "floating." However, the experiments of the New Jersey Stations have shown that freshened oysters will not remain alive as long as those taken directly from salt water. Freshening increases very rapidly the rate of weakening and decay (the life period being reduced one-half).

Frequently oysters become more or less green in color. There is a widespread opinion that "greening" is injurious. The color has been attributed to disease, to parasites, and to the presence of copper. It is in reality due to the fact that the oysters have fed on green plants of very simple structure which are sometimes found in abundance in brackish or salt water. The green coloring matter of the plants is soluble in the oyster juices and colors the tissues. The opinion of those who have investigated the matter carefully is that the green color is harmless. In Europe green oysters are more highly prized than others. The green color may be removed by placing the oysters for a time in water where the green plants are not abundant.

Lobsters, crabs, shrimps, and crawfish are shown by analysis to contain a fairly large percentage of nutrients. This is more noticeable when the composition of the flesh alone is considered. Lobsters and similar foods are prized for their delicate flavor. Except in certain regions where they are very abundant and the cost correspondingly low they must be regarded as delicacies rather than as staple articles of diet. This is, however, a condition entirely apart from their composition. Judged by this alone, they are valuable foods, and may profitably be employed to give variety to the diet.

Although the total amount of turtle and terrapin used in the United States is considerable, the quantity is small as compared with the consumption of such foods as fish proper and oysters. As shown by their composition, turtle and terrapin are nutritious foods, although, under existing conditions, they are expensive delicacies rather than staple and economical articles of diet.

The total amount of frogs consumed per year for food is considerable. As shown by analysis, frogs' legs contain a considerable amount of protein. Only the hind legs are commonly eaten. The meat on other portions of the body is edible, although the amount is small, and is eaten in some localities. The prejudice which formerly existed against frogs' legs as a food was doubtless based on their appearance or some similar reason, as they are known to be wholesome.

COST OF PROTEIN AND ENERGY IN FISH AND OTHER FOOD MATERIALS.

As previously stated, the two functions of food are to furnish protein for building and repairing the body and to supply energy for heat and muscular work. Although fish and meats in general may be regarded as sources of protein, they nevertheless furnish considerable energy. Indeed, those containing an abundance of fat supply a large amount of energy—that is, have a high fuel value. If a food contains little protein or energy and is high in price, it is evident that it is really an expensive food. On the other hand, a food may be high in price but in reality be cheap, since it furnishes a large amount of protein or energy or both. Foods which supply an abundance of protein or energy or both at a reasonable price are evidently of the greatest importance from an economical standpoint.

In Table 2 is shown how much a pound of protein, or 1,000 calories of energy, would cost when supplied by a number of kinds of fish and other foods at certain prices.

TABLE 2.—*Comparative costs of protein and energy as furnished by a number of food materials at certain prices.*

Kind of food material.	Price per pound.	Cost of protein per pound.	Cost of energy per 1,000 calories.
	Cents.		
Codfish	10	$0.94	$0.49
Codfish steaks	12	.71	.36
Blue fish	12	1.22	.59
Halibut	18	1.18	.38
Cod, salt	7	.44	.22
Mackerel, salt	10	.68	.11
Salmon, canned	12	.55	.13
Oysters, "solids" (30 cents per quart)	15	2.50	.65
Oysters, "solids" (60 cents per quart)	30	5.00	1.30
Beef, sirloin	25	1.53	.26
Do	20	1.23	.21
Beef, round	14	.77	.16
Beef, stew meat	5	.36	.07
Beef, dried "chipped"	25	.97	.32
Mutton chops (loin)	20	1.54	.14
Mutton leg	22	1.48	.25
Pork roast (loin)	12	.85	.09
Pork, smoked ham	22	1.65	.13
Milk (7 cents per quart)	3½	1.06	.11
Milk (6 cents per quart)	3	.91	.09
Lobster	18	3.05	1.24
Wheat flour	3	.27	.02
Corn meal	2	.22	.01
Potatoes (90 cents per bushel)	1½	.88	.05
Potatoes (45 cents per bushel)	¾	.44	.02
Cabbage	2½	1.79	.20
Corn, canned	10	3.57	.22
Apples	1⅓	5.00	.07
Bananas	7	8.75	.22
Strawberries	7	7.00	.38

In the table the prices per pound have been selected from the best data available. It is of course impossible to set any one price which shall represent the cost of these materials per pound in all sections of the country and at all times of the year. It is probable that the prices given represent more nearly those found in the eastern part of the country than in the southern, central, and western sections, where most of the food materials are usually somewhat cheaper.

It is to be noted that the cost of 1 pound of protein and 1,000 calories of energy have no direct relation to each other. A pound of protein would be sufficient for a workingman nearly four days, while 1,000 calories of energy would be less than one-third the amount required per day. By dividing the cost of 1 pound of protein by 4 and multiplying the cost of 1,000 calories of energy by 3.5 results are obtained which show the relative cost of the protein and energy sufficient for one day as furnished by the different food materials. Thus it would take 25 cents' worth of salt mackerel at 10 cents a pound to furnish one day's supply of protein, while the corresponding energy would require 38 cents' worth. Seven cents' worth of flour would furnish the protein and 5 cents' worth the energy required for one day. It is of course understood that no one food material could furnish the nutrients in the proper proportions for adults under ordinary conditions of health and activity. The values expressed in the table simply show the relative value from a pecuniary standpoint of the different foods as a source of protein on the one hand and of energy on the other.

It will be seen from the above table that at 25 cents a pound it would take $1.53 worth of sirloin steak to furnish a pound of protein, while the same amount could be obtained in 77 cents' worth of beef round at 14 cents a pound, 71 cents' worth of cod steak at 12 cents a pound, 44 cents' worth of salt cod at 7 cents a pound, or 27 cents' worth of wheat flour at 3 cents a pound. In like manner the cost of 1,000 calories of energy would vary in these same food materials from 36 cents, as furnished by the cod steaks, to 2 cents as furnished by the flour.

It is evident that at the prices given the fruits are the most expensive sources of protein, mollusks and crustaceans next, and the cheaper meats and fish, with the cereals the least expensive. As regards energy, on the other hand, mollusks and crustaceans are by far the most expensive sources, followed by fish and many kinds of meat, while the cereals are the most economical.

DIGESTIBILITY OF FISH.

The term digestibility, as commonly employed, has several significations. To many persons it conveys the idea that a particular food agrees with the user. It is also very commonly understood to mean the ease or rapidity of digestion. One food is often said to be preferable to another because it is more digestible, i. e., is digested in less time. A third meaning, and one which is usually understood in scientific treatises on such subjects, refers to the completeness of digestion.

For instance, two foods may have the same composition, but, owing to differences in mechanical condition or some other factor, one may be much more completely digestible than the other; that is, give up more material to the body in its passage through the intestinal tract.

The agreement or disagreement of a particular food with any person is largely a matter of individual peculiarity. When foods habitually disagree with a person, and there is reason to believe that there is pronounced indigestion, the advice of a competent physician is needed, since the nourishment of an abnormal or diseased body is a matter properly included under the practice of medicine.

In so far as ease or rapidity of digestion implies a saving of energy to the body, it is a matter of importance. However, little is known concerning relative rapidity of digestion within the body. Most of the current statements which refer to this are apparently based on experiments carried on outside the body by methods of artificial digestion. Such experiments imitate as closely as possible the conditions in the body, but it is not at all certain that they are exactly the same. The application of the results of such experiments is properly the province of trained investigators, who, it is worthy of note, are much more guarded in their statements than less well-informed persons.

Numbers of artificial-digestion experiments have been made with fish. These indicate that fish is less quickly digested than beef, being about equal to lamb in this respect. However, as compared with other foods, the difference in digestibility of fish and meat is not very great. Before sweeping deductions are made the thoroughness with which fish is digested should also be taken into account.

A number of experiments have been made with man to learn how thoroughly fish is digested and to compare it in this respect with other foods. In these experiments the food and feces were analyzed. Deducting the nutritive material excreted in the feces from the total amount consumed in the food showed how much was retained by the body. It was found that fish and lean beef were about equally digestible. In each case about 95 per cent of the total dry matter, 97 per cent of the protein, and over 90 per cent of the fat were retained by the body. Other experiments of the same character indicate that salt fish is less thoroughly digested than fresh fish.

A number of similar experiments have been made on the digestibility of milk, eggs, bread, potatoes, and other animal and vegetable foods. From them some general deductions have been drawn. Leaner meats are probably more easily digested than those containing more fat, and the leaner kinds of fish, such as cod, haddock, perch, pike, bluefish, etc., are more easily and completely digested than the fatter kinds, as salmon, shad, and mackerel. Generally speaking, it has been found that the protein of vegetable foods is less digestible than that of animal foods. For instance, one-fourth or more of the protein of potatoes and beans may escape digestion and thus be useless for nourishment. This

is perhaps entirely due to the mechanical condition in which the protein occurs in vegetable foods; that is, it is often inclosed in cells which have hard walls and are not acted upon by the digestive juices. It is ordinarily assumed that the small amount of carbohydrates in meat and fish is entirely digested. Carbohydrates other than fiber, which make up the larger part of the vegetable foods, are very digestible. The fat in both animal and vegetable foods differs in digestibility under varying conditions. No marked difference in the digestibility of the fat in the two classes of food can be pointed out.

Persons differ in respect to the action of foods in the digestive apparatus; and fish, like other food materials, is subject to these influences of personal peculiarity.

The nutritive value of shellfish, as of other fish, depends to a considerable extent upon their digestibility; but so little is known upon this point that but little can be said with certainty here. Perhaps the most that can be said is that while there are people with whom such foods do not always agree, yet oysters belong to the more-easily digestible class of foods. So far as can be learned no experiments have been made which show how thoroughly crabs, clams, and other crustacea, turtle and terrapin, and frogs' legs are digested.

PLACE OF FISH IN THE DIET.

The chief uses of fish as food are (1) to furnish an economical source of nitrogenous nutrients and (2) to supply the demand for variety in the diet, which increases with the advance of civilization.

Inspection of a considerable number of dietary studies of families of farmers, mechanics, professional men, and others, carried on in different regions of the United States, shows that from one-half to two-thirds of the protein of the food is obtained from animal sources—i. e., meats, milk, eggs, and fish. In most cases fish furnish less than 5 per cent of the animal protein, showing to what a limited extent this food is used in the average household. It is not improbable that in communities where fisheries constitute the principal industry much larger quantities are consumed. It has been found that the laborers employed in the fisheries in Russia consume from 26 to 62 ounces of fish daily. This, with some bread, millet meal, and tea, constitutes the diet throughout the fishing season. These quantities are unusually large, but no bad effects are mentioned as following the diet.

There is a widespread notion that fish contains large proportions of phosphorus, and on that account is particularly valuable as brain food. The percentages of phosphorus in specimens thus far analyzed are not larger than are found in the flesh of other animals used for food. But, even if the flesh be richer in phosphorus, there is no experimental evidence to warrant the assumption that fish is more valuable than meats or other food material for the nourishment of the brain.

The opinion of eminent physiologists is that phosphorus is no more essential to the brain than nitrogen, potassium, or any other element which occurs in its tissues. The value commonly attributed to the phosphorus is based on a popular misconception of statements by one of the early writers on such topics. In discussing the belief that "fish contains certain elements which are adapted in a special manner to renovate the brain and so to support mental labor" a prominent physiologist says, "There is no foundation whatever for this view."

It is well understood that persons in varying conditions of life and occupation require different kinds and quantities of food. For the laboring man doing heavy work the diet must contain a comparatively large amount of the fuel ingredients and enough of the flesh-forming substances to make good the wear and tear of the body. These materials are all present in the flesh of animals, but not in the requisite proportions. Fish and the leaner kinds of meat are deficient in materials which yield heat and muscular power. When, however, fish and meat are supplemented by bread, potatoes, etc., a diet is provided which will supply all the demands of the body. Where fish can be obtained at low cost it may advantageously furnish a considerable portion of the protein required, and under most conditions its use may be profitably extended solely on the plea of variety.

It should be stated that most physiologists regard fish as a particularly desirable food for persons of sedentary habits. While, so far as can be learned, such statements do not depend upon experimental evidence, they are thought to embody the result of experience.

PREPARING FISH FOR THE TABLE.

Fish is prepared for the table in a variety of ways, which are described in detail in books devoted to cookery. A few words, however, may not be inappropriate on the general methods of cooking and possible loss of nutrients involved.

Fish is commonly boiled, steamed, broiled, fried, or baked, or may be combined with other materials in some made dish. When boiled, it is stated that the loss in weight ranges from 5 to 30 per cent. One experimenter gives 26 per cent as the average. This loss is largely made up of water—that is, the cooked fish is much less moist than the raw. Little fat or protein is lost. So far as known, experiments have not been made which show the losses by other methods of cooking. It is, however, probable that there would be usually a very considerable loss of water.

In most cases fat or carbohydrates in the form of butter, flour, or other material are added to fish when cooked, and thus the deficiency in fuel ingredients is made good. Boiled or steamed fish is often accompanied by a rich sauce, made from butter, eggs, etc. Fried fish is cooked in fat, and baked fish is often filled with force meat, and may also be accompanied by a sauce. The force meat being made of bread, butter,

etc., contains fat and carbohydrates. In made dishes—chowders, fish pies, salads, etc.—fat and carbohydrates (butter, flour, vegetables, etc.), are combined with fish, the kind and amount varying in the individual cases. Furthermore, in the ordinary household, fish or meat is supplemented by such foods as bread, butter, potatoes, green vegetables, and fruit. That is, by adding materials in cooking and by serving others with the cooked product the protein of the fish is supplemented by the necessary fat and carbohydrates.

DAILY MENUS CONTAINING FISH.

By taking into account the chemical composition of a mixed diet and comparing it with accepted dietary standards it may be seen whether the diet is actually suited to the requirements of the body; that is, whether it supplies sufficient protein and energy and whether it supplies them in the right proportions.

A number of sample menus are given on pp. 24–27, which show that the desired amounts of protein and energy may be readily supplied by a diet containing a considerable amount of fish. These menus (which are based in part on dietary studies and other food investigations of this Department covering a wide range and extending over several years) are not intended as formulas for any family to follow, but simply as illustrations of the way in which menus containing the proper proportions of nutrients may be made up. The ingenuity of the housewife and her knowledge of the tastes of the family will suggest the special dishes and combinations suited to her needs. It is not assumed that any housewife will find it convenient to follow exactly the proportions suggested in the menus. The purpose is to show her about what amounts and proportions of food materials would give the required nutrients.

With reference to the following menus several points should be borne in mind. The amounts given represent about what would be called for in a family whose demand for food would be equivalent to four full-grown men at ordinary manual labor, such as machinists, carpenters, mill workers, farmers, truckmen, etc., according to the usually accepted standards. It is ordinarily assumed that an average man in health performing a moderate amount of muscular work requires per day about 0.28 pound protein and 3,500 calories of energy, the latter being supplied in small part by protein, but mostly by fat and carbohydrates. Men in professional life, performing less muscular work, require smaller amounts. Accepted dietary standards for such men call for 0.22 to 0.25 pound protein and from 2,700 to 3,000 calories of energy in the daily food. The amount of mineral matter required is not stated, since there is little accurate information available on this point. A diet made up of ordinary foods and supplying the necessary amounts of protein and energy would undoubtedly supply an abundance of mineral matter.

It has been found that women and children consume somewhat less food than men. The assumption is usually made that, provided a woman is engaged in some moderately active occupation she requires about eight-tenths as much food as a man.

In calculating the results of dietary studies (which may be most conveniently expressed in amounts for one man for one day), it is further assumed that a boy 14 to 16 years old requires about eight tenths as much food as a man at moderate muscular labor; a girl 14 to 16 years old, about seven-tenths; a child 10 to 13, about six tenths; one 6 to 9 years old, about five-tenths; one 3 to 5, about four-tenths, and an infant under 3 years, about three tenths.

As previously stated, the quantities in the sample menus are for four men at moderate muscular work or an equivalent number of men, women, and children. A family might, for example, consist of a mechanic and wife, with four children, two girls of 12 and 6 and two boys of 10 and 8 years, respectively. Here it would be assumed that the man would be engaged at moderately hard manual work. According to the above factors, this family would be equal in food consumption to 4 men at moderate muscular exercise ($1.0+0.8+0.6+0.6+0.5+0.5=4$). In the same way a day laborer's family consisting of a father and mother with three children under 7 years of age would be equivalent to 3 men with moderate muscular exercise ($1.0+0.8+0.5+0.4+0.3=3$), and would require three-fourths the quantities indicated in the following menus:

MENU I.—*For family equivalent to four men at moderate muscular work.*

Food material.	Weight.		Protein.	Fuel value.
Breakfast.	*Lbs.*	*Oz.*	*Pounds.*	*Calories.*
Oranges	2	0	0.012	300
Rolled oats:				
Oats		4	.042	462
Milk		6	.012	120
Sugar		2	....	235
Omelet (8 eggs)	1	0	.131	630
Butter for frying		1	....	220
Johnnycake *a*	1	4	.106	1,438
Butter		3	.001	660
Coffee	....		.008	250
Total	....		.312	4,315
Dinner.				
Boiled cod, fresh	2	0	.340	670
Hollandaise sauce:				
Butter		4	.002	880
Yolks of 2 eggs		1½	.012	136
Lemon juice, etc	....		....	....
Potatoes	2	0	.034	620
Spinach	1	4	.027	138
Butter		1	....	220
Bread pudding:				
Bread		4	.024	301
Milk	1	8	.049	487
1 egg		2	.016	81
Sugar		3	....	350
Butter		½	....	105
Bread		12	.071	910
Butter		4	.002	880
Total	....		.577	5,778

a Composition of cooked material.

MENU I.—*For family equivalent to four men at moderate muscular work*—Continued.

Food material.	Weight.		Protein.	Fuel value.
Supper.				
Scalloped oysters:	*Lbs.*	*Oz.*	*Pounds.*	*Calories.*
Oysters	2	0	.120	460
Crackers		4	.025	498
Butter		2	.001	440
Milk		4	.008	81
French fried potatoes	1	0	.017	310
Lard (taken up in frying)		2	....	530
Bread		8	.047	610
Butter		2	.001	440
Sliced bananas	1	0	.006	310
Sugar		4	....	465
Tea	....		.008	250
Total	....		.233	4,394
Total per day	....		1.122	14,487
Total for one man	....		.28	3,622

MENU II.—*For family equivalent to four men at moderate muscular work.*

Food material.	Weight.		Protein.	Fuel value.
Breakfast.				
Creamed codfish:	*Lbs.*	*Oz.*	*Pounds.*	*Calories.*
Salt codfish		8	.111	253
Milk	1	0	.033	325
Butter		1	....	220
Flour		1	.007	103
Baked potatoes *a*	2	0	.034	620
Bread		12	.071	910
Butter		4	.002	880
Coffee	....		.008	250
Total	....		.266	3,561
Dinner.				
Fish soup:				
Halibut	1	0	.153	470
Milk	2	0	.066	650
Butter		1	....	220
Flour		1	.007	103
(Onion, salt, pepper)	....		....	....
Roast lamb, loin *b*	1	8	.195	2,167
Green peas *c*	1	12	.039	350
Butter		1¾	.001	380
Mashed potatoes *a*	1	8	.025	465
Bread		6	.036	455
Butter		1	....	220
Apple pie	1	0	.031	455
Total	....		.553	5,935
Supper.				
Lobster salad:				
Lobster meat	1	0	.164	390
Yolks of 3 eggs		2	.018	204
Butter or oil		3	.002	660
Milk		8	.017	162
Sugar		1	....	118
(Vinegar, salt, pepper, mustard)	....		....	....
Biscuit	1	0	.084	1,430
Butter		4	.002	880
Tea	....		.008	250
Total	....		.350	4,094
Total per day	....		1.179	13,590
Total for one man	....		.29	3,398

a Composition of cooked material.
b A larger roast would ordinarily be cooked. The amount given would be sufficient for one meal.
c Weight with pods.

MENU III.—*For family equivalent to four men at moderate muscular work.*

Food material.	Weight.	Protein.	Fuel value.
Breakfast.	*Lbs. Oz.*	*Pounds.*	*Calories.*
Bananas or grapes	1 0	.009	325
Rolled oats:			
Oats	4	.042	465
Milk	6	.012	120
Sugar	2	....	235
Creamed dried beef:			
Dried beef	12	.194	585
Milk	8	.017	163
Butter	1	....	220
French fried potatoes	1 0	.017	310
Lard (taken up in frying)	2	....	530
Bread	12	.071	910
Butter	3	.001	660
Coffee	....	.008	250
Total	....	.371	4,773
Dinner.			
Halibut steak	2 0	.306	940
Mashed potatoes	2 0	.034	620
Tomatoes (or half the amount of parsnips)	2 0	.018	210
Bread	12	.071	910
Butter	4	.002	880
Caramel custard:			
Milk	1 0	.033	325
2 eggs	4	.033	158
Sugar	4	....	470
Total	....	.497	4,513
Supper.			
Salmon croquettes:			
Canned salmon	8	.109	458
Mashed potatoes *a*	1 0	.017	310
Butter	½	....	110
1 egg	2	.016	79
Lard (taken up in frying)	1	....	265
Preserves	1 0	.008	1,150
Muffins	12	.089	982
Butter	4	.002	880
Tea	....	.008	250
Total	....	.249	4,484
Total per day	....	1.117	13,770
Total for one man	....	.279	3,443

a Composition of cooked material.

MENU IV.—*For family equivalent to four men at moderate muscular work.*

Food material.	Weight.	Protein.	Fuel value.
Breakfast.			
Oatmeal:	*Lbs. Oz.*	*Pounds.*	*Calories.*
Oatmeal	4	.042	465
Milk	6	.012	120
Sugar	2	....	235
Broiled salt mackerel	1 8	.209	1,733
Boiled potatoes	1 0	.017	310
Hot rolls	12	.077	1,148
Butter	3	.001	660
Coffee	....	.008	250
Total	....	.366	4,921
Dinner.			
Broiled beefsteak	2 0	.366	1,790
Baked potatoes *a*	1 8	.025	465
Onions	2 0	.030	430
Bread	12	.071	910
Butter	3	.001	660

a Composition of cooked material.

MENU IV.—*For family equivalent to four men at moderate muscular work*—Continued.

Food material.	Weight.	Protein.	Fuel value.
Dinner—Continued.			
Baked apples:	*Lbs. Oz.*	*Pounds.*	*Calories.*
Apples	1 0	.004	255
Sugar	2	....	235
Cream	4	.006	228
Total	....	.503	4,973
Supper.			
Oyster stew:			
1 pint oysters	1 0	.060	230
1 pint milk	1 0	.033	325
Butter	2	.001	440
Crackers	6	.038	746
Bread	8	.047	610
Butter	2	.001	440
Currant jam	6	.004	546
Cake	8	.032	688
Tea	....	.008	250
Total	....	.224	4,275
Total per day	....	1.093	14,169
Total for one man	....	.275	3,542

The weights of fish, meats, and vegetables given in the menus are for these articles as found in the market. The fish and meats will include, as a rule, more or less bone, and the vegetables considerable skin and other parts, which are inedible and are rejected. In estimating the nutrients allowance is made for what has been found to be the average proportion of bone in different cuts of meats. In vegetables it is assumed that from one-sixth to one-fifth will be rejected in preparing them for the table. The weights of the breakfast cereals are for these in the dry condition before cooking.

The values given for tea or coffee are obtained by taking account of the sugar and milk or cream consumed with them. The infusion of tea or coffee contains little, if any, nutritive material. The value of tea and coffee in the diet depends upon their agreeable flavor and mild stimulating properties.

The calculations of the quantities of nutrients contained in the different foods are based upon the average percentage composition of these materials. The fats and carbohydrates in the different food materials are not shown in the menus. The quantity of protein and the fuel value of the food are the values which are of special interest. The fuel value of the fats and carbohydrates is, of course, included in the figures for fuel value given.

In the menus only such an amount of each food is indicated as might be completely consumed at each meal. Of course, in the ordinary household, there will usually be a rather larger quantity of the different dishes prepared than will be consumed at one meal, but the thrifty housekeeper will see to it that what is not used at one meal will be utilized for another.

It is not expected that each meal or the total food of each individual day will have just the amounts of protein and fuel ingredients that make a well balanced diet. The body is continually storing nutritive materials and using them. It is a repository of nutriment which is being constantly drawn upon and as constantly resupplied. It is not dependent any day upon the food eaten that particular day. Hence an excess one day may be made up by a deficiency the next or vice versa. Healthful nourishment requires simply that the nutrients as a whole during longer or shorter periods should be fitted to the actual needs of the body.

It will be seen that in each of the menus suggested fish occurs in at least two meals. However, in no case is the amount greater than experience has shown may occur in actual dietaries..

It is not the intention to suggest that a diet containing such quantities of fish be followed every day, but rather to show that fish may be readily combined with other food materials to supply the protein and energy required. While it may profitably be used more frequently in many families than is at present the case, this is a matter of individual taste.

The menus attempt to cover, as regards fish and other materials, a range in variety and combination such as might be found in an average well-to-do household. Individual tastes vary so much that no combination which could be selected would meet them all.

Nothing has been said of the cost of the foods used in the menus. All foods vary in price in different localities, and this is especially the case with fish. In general, it may be said that a large variety of fruits, vegetables, etc., increases the cost of a diet out of proportion to the nutritive material furnished. Such foods, however, are valuable, since they possess agreeable flavor and so render the diet appetizing. It is also generally believed that the acids, salts, and similar materials in fruits and vegetables are of value in maintaining the body in health. The income of the purchaser should determine how varied the diet may be.

POSSIBLE DANGERS FROM EATING FISH.

In view of statements of a popular nature which have been made on the dangers from eating poisonous fish or from ptomaines contained in fish, a few words summarizing the actual knowledge on these topics seems desirable.

There are several species of fish which are actually poisonous. Few of them, however, are found in the United States, and the chances of their being offered for sale are very small. Such fish are mostly confined to tropical waters.

Fish may contain parasites, some of which are injurious to man. These are, however, destroyed by the thorough cooking to which fish is usually subjected.

Ptomaines are poisonous bodies due to the action of micro-organisms. They are chemical compounds of definite composition and are elaborated by micro-organisms breaking down the complex ingredients of animal tissues, just as alcohol is due to the action of yeasts breaking down sugar, or as acetic acid is due to the action of *Mycoderma aceti* breaking down alcohol. The formation of ptomaines quite generally, although not always, accompanies putrefaction (often in its early stages), and, therefore great care should be taken to eat fish only when it is in perfectly good condition. Fish which has been frozen and, after thawing, kept for a time before it is cooked is especially likely to contain injurious ptomaines.

Canned fish should never be allowed to remain long in the can after opening, but should be used at once. There is some possibility of danger from the combined action of the can contents and oxygen of the air upon the lead of the solder or the can itself. Furthermore, canned fish seems peculiarly suited to the growth of micro-organisms when exposed to the air.

Finally, fish offered for sale should be handled in a cleanly manner and stored and exposed for sale under hygienic conditions.

Oysters when "floated" or "fattened" should never be placed in water contaminated by sewage. Severe illness and death have resulted in a number of cases from eating raw oysters contaminated with sewage containing typhoid fever germs.

It is only just to say that the dangers from parasites, micro-organisms, ptomaines, and uncleanly surroundings are not limited to fish. Under conditions which favor the growth of the micro-organisms, meat and other highly nitrogenous animal foods undergo decomposition resulting in the formation of ptomaines. Animal parasites may be acquired from flesh of various kinds if not thoroughly cooked, provided of course the flesh is infested. This danger is reduced by proper inspection. Vegetable foods also may become contaminated in various ways. The importance of measures to secure pure and wholesome food can hardly be overstated. The best interests of the people undoubtedly demand a strict and impartial supervision by public officers of the sale of food products.

FARMERS' BULLETINS.

These bulletins are sent free of charge to any address upon application to the Secretary of Agriculture, Washington, D. C. Only the following are available for distribution:

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No. 18. Forage Plants for the South. Pp. 30.
No. 19. Important Insecticides: Directions for Their Preparation and Use. Pp. 20.
No. 21. Barnyard Manure. Pp. 32.
No. 22. Feeding Farm Animals. Pp. 32.
No. 23. Foods: Nutritive Value and Cost. Pp. 32.
No. 24. Hog Cholera and Swine Plague. Pp. 16.
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